European Committee for Future Accelerators

AstroParticle Physics European Consortium

Carlos Peña Garay

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AstroParticle Physics European Consortium

APPEC was created in 2012. It emanated from the Astroparticle Physics European Coordination committee founded in 2001 and operates under the same acronym. APPEC is the outcome of a decade of preparatory work by a consortium of representatives from ministries and agencies, and of intense preparatory work provided by the EU-funded ERANETs, ASPERA and ASPERA-2 (2006-2012).

International coordination structure based on MoU signed by directors of major institutes and agencies or by managers of AP programs and an APPEC Common Fund with the **strategic objectives:**

Provide a discussion forum for the coordination of European Astroparticle Physics and express collective views on astroparticle physics in international fora.

Develop and update long term strategies and participate in European scientific strategy Organizations.

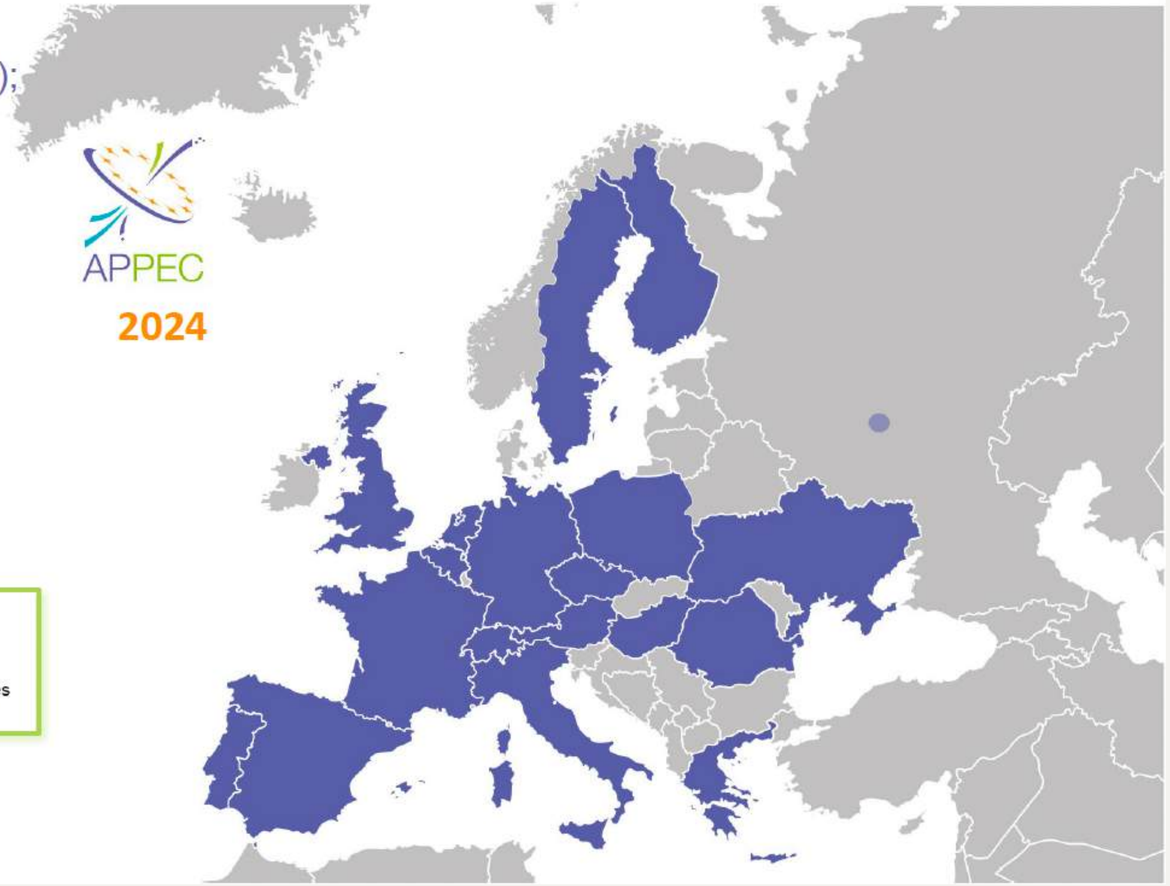
Develop closer relationships with organizations involved in Astroparticle Physics research.

APPEC Organization and Coordination with Various Organizations

- **General Assembly**
  - Strategic, decision making and supervisory body
  - Representatives of funding agencies
  - Chair: Andreas Haungs (KIT), Carlos Peña Garay (Canfranc);
  - Vice-Chair: Antoine Kouchner (APC)
- **Scientific Advisory Committee**
  - Advisory body
  - Chair: Aldo Ianni (LNGS) since 2024;
  - Vice-Chair: Mathieu de Naurois (CNRS) since 2024
- **Joint Secretariat (distributed office)**
  - Executive body chaired by the General Secretary
  - General Secretary: Julie Epas (APC)
- **Observer**
  - CERN (Joachim Mnich)
  - ECFA (Paris Sphicas)
  - NuPECC (Marek Lewitowicz)
  - Astronet (NN, Martin Giard)
  - ESO (Andy Williams)
  - EPS-HEPP (Ramon Miquel)
  - EuCAPT (Silvia Pascoli)

JENAA
Joint ECFA-NuPECC-APPEC Activities

www.appec.org



Mid-term update shows some significant updates of the strategy for a good number of topics. And the pace at which Astroparticle Physics research is moving will likely accelerate in the next few years. In addition to the scientific progress that will change our perspective, society at large, of which the Astroparticle Physics community is part, is changing.

The new APPEC Astroparticle Physics Strategy from 2027 onwards will likely not be business as usual. It will require yet another thorough discussion in our community, which should be held in the years 2025 and 2026 and be prepared before that time, starting in 2024.

It will strongly benefit by the efforts currently don in the accelerator and nuclear physics communities

Current Actions:

- JS and Chair elected in 2024 for the 2025-2026 period.
- Scientific Advisory Committee renewed in 2024
- October 2024: Survey online to engage with the European Astroparticle Physics community in order to collect views and information for the APPEC 2027-2036 roadmap.
- June 2025: Town meeting - to be announced after approval in next GA meeting (Dec 4-5)

APPEC roadmap – scientific/technical topics

- Cosmic rays
- High-energy neutrinos
- High-energy photons
- Gravitational waves
- WIMP Dark Matter
- Non-WIMP Dark Matter
- Neutrino properties
- Cosmic Microwave Background
- Dark Energy
- Multi-messenger astroparticle physics
- Astroparticle theory
- Detector R&D
- Computing and data policies

- Ecological Impact
- Societal Impact
- Open Science and Citizen Science
- Human Talent Management
- Central Infrastructures
- European and Global Cooperation
- Interdisciplinary Opportunities

Recommendations are given for each topic

Roadmap in a nutshell

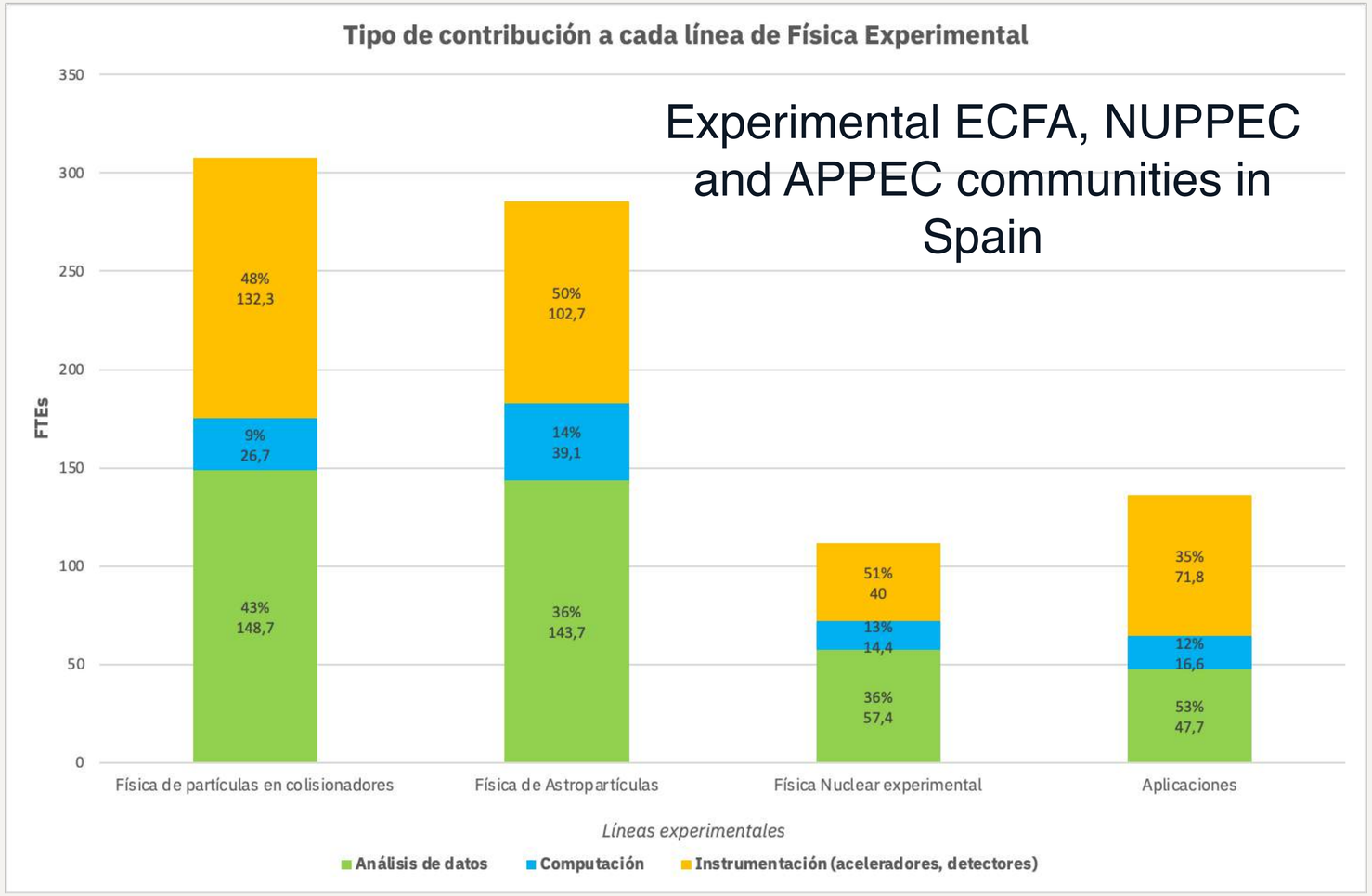
- **High-energy photons** (gamma astronomy):
  - support construction and long-term operation of CTA (10GeV-100TeV)
  - support work towards next-generation (THESEUS, SWGO)
- **High-energy neutrinos** (neutrino astronomy):
  - support operation of KM3NeT through ARCA and ORCA
  - support expansion of Ice-cube (x10) and precision neutrino astronomy
- **Cosmic rays**
  - Support completion of AugerPrime
  - Exploitation of Auger and TA sky coverage
- **Neutrino propertis**
  - Support EU in leading NLDBD research
  - Support mass ordering research in KM3NeT, DUNE, HyperK, direct mass measurements
- **Theory**
  - Support EuCAPT as a coordination centre
- **Gravitational waves**
  - Support EU participation in ET and reinforce EU leadership
- **Dark Matter**
  - Support EU leadership with one next-generation experiment with Argon or Xenon
  - Support cavity technology for axion search
- **CMB**
  - Encourage EU contribution to LiteBIRD mission, Stage4 and R&D for ground-based projects
- **Dark Energy**
  - Support Euclid mission and participation in ground-based projects (DESI, Rubin-LSST)
- **Multi-messenger**
  - Support coordination of multi-messenger observational strategies
- R&D, ecological impact, societal impact, open science, training young scientists

APPEC community members is over 5000 (2000+ theorists)

Currently working on the actual number and distribution in Europe.

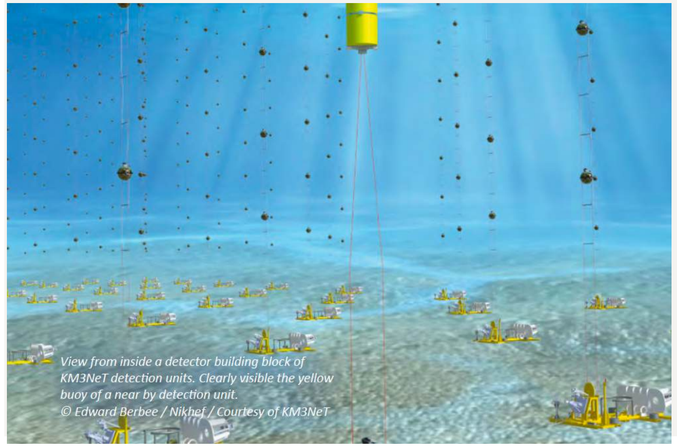
Example (Preliminary!) : Spain (by CPAN: Particle, Nuclear and Astroparticle Physics communities)

2000+ theorists registered in EuCAPT

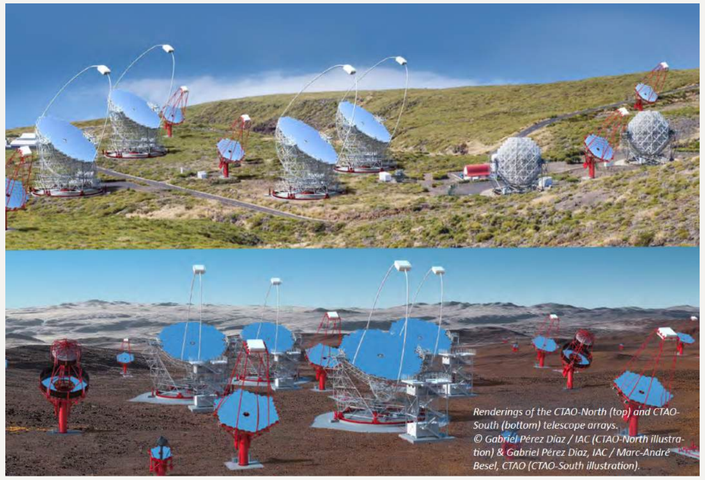


ESFRI and APPEC RIs

- APPEC RIs included in ESFRI roadmap
  - ✓ KM3NeT
  - ✓ CTA
  - ✓ ET
- DULs considered essential key RIs to Astroparticle Physics projects
- Underlined APPEC role and recommendations to support Astroparticle Physics advancement



View from inside a detector building block of KM3NeT detection units. Clearly visible the yellow buoy of a near by detection unit.
© Edward Berbee / Nikhef / Courtesy of KM3NeT



Renderings of the CTAO-North (top) and CTAO-South (bottom) telescope arrays.
© Gabriel Pérez Díaz / IAC (CTAO-North illustration) & Gabriel Pérez Díaz, IAC / Marc-André Besel, CTAO (CTAO-South illustration).

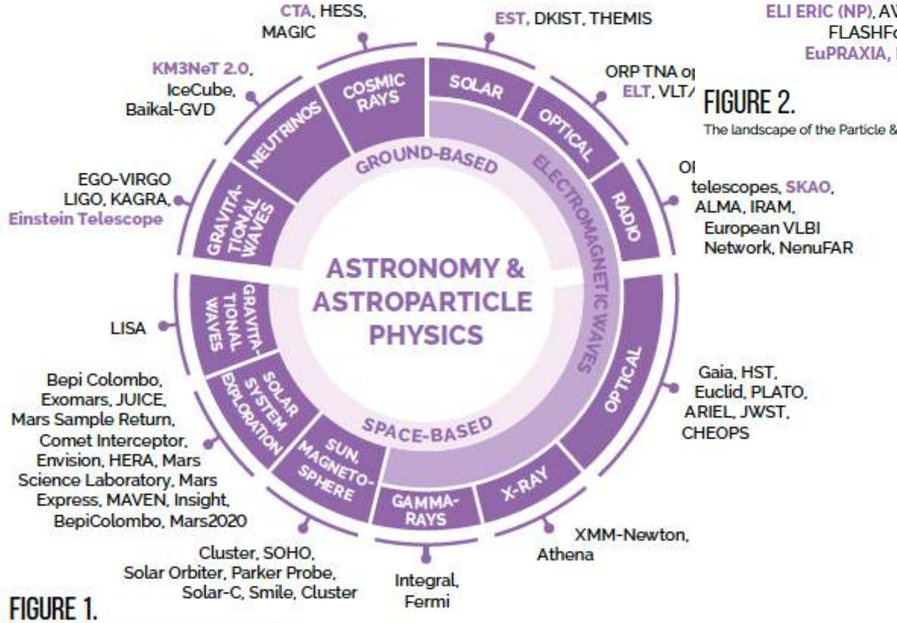


FIGURE 1.
The landscape of the Astronomy & Astroparticle Physics sub-domain

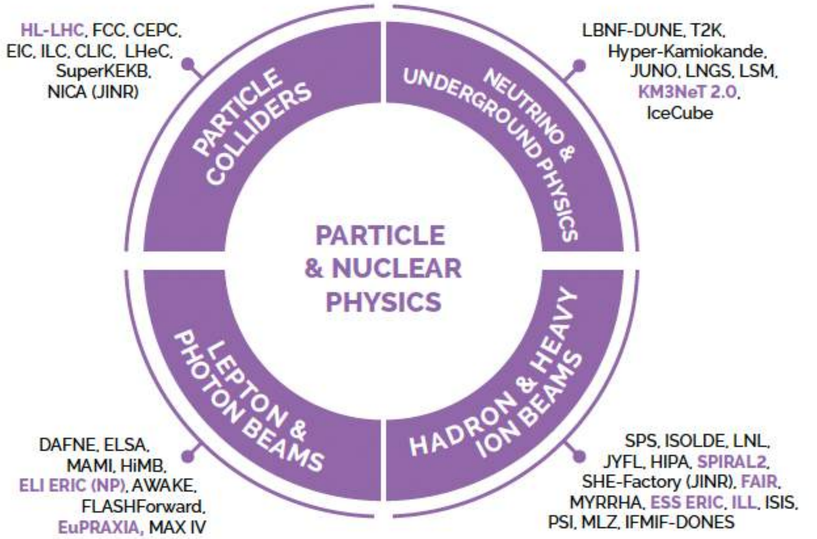
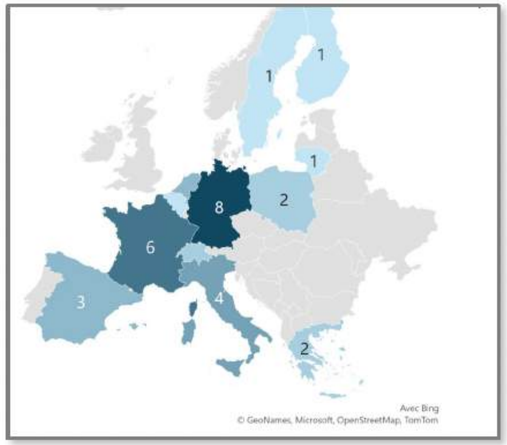


FIGURE 2.
The landscape of the Particle & Nuclear Physics sub-domain

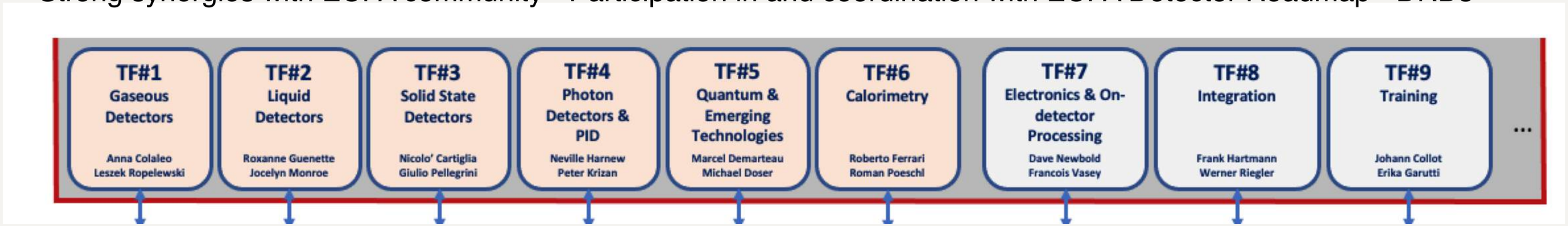
ACME - Astrophysics Centre for Multi-messenger studies in Europe

HORIZON-INFRA-2023-SERV-01-02 (domain: Astronomy & Astroparticle physics)

- Topic: **better access of users to RI services to advance frontier knowledge**
- **ACME is an ambitious coordinated European-wide optimization of the accessibility and cohesion between multiple leading RI, offering access to instruments, data and expertise.**
- Selected for funding by the European Commission: 14.5 M€ (in Feb 2024)
- Provides Transnational access (TA) and Virtual Access (VA) to RI
- Consortium: 41 partners, 15 countries, >30 research infrastructures
- Grant Agreement Preparation phase



Strong synergies with ECFA community - Participation in and coordination with ECFA Detector Roadmap - DRDs



European leadership in Dark Matter direct detection and Double Beta Decay, underpinned by the pioneering LNGS program, to realize at least one next-generation xenon (~50 tons) or argon (order 300 tons) detector and the LEGEND-1000 DBD detector and the unique European-led efforts for solar axions, and comological axions.

Two big caverns are (almost) finished in the USA and Japan to host the largest neutrino detectors ever able to search for CP violation in the lepton sector and to look at the sky in MeV- GeV neutrinos (solar, atmospheric, supernovae, …).

Very big European contingency in both large collaborations, with strong contributions to the detector construction.

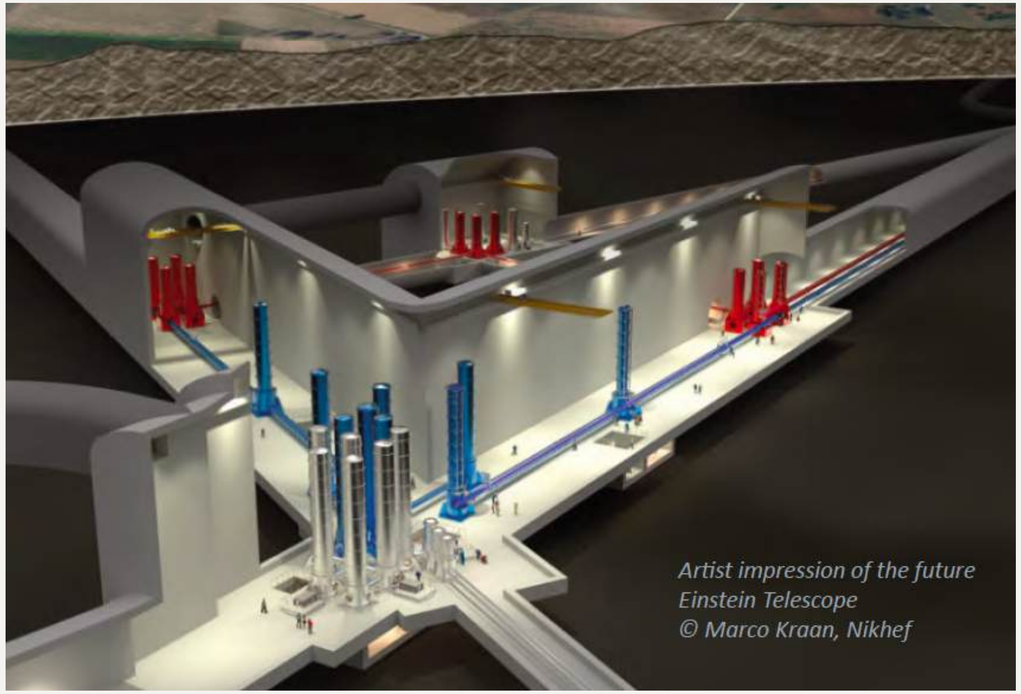
APPEC strongly supports actions to enlarge European countries' participation in ET, acquire funds for ET construction and operations, and develop the ET scientific community. APPEC supports building the bridge between second and third-generation detectors to maintain European expertise and leadership in the field and the VIRGO observation capability up to when the ET will start observations. APPEC strongly supports the LISA mission.

ET is a very ambitious project with many challenges and a rich physics program.

Work in progress on the preparation of the European participation in ET.

Location, budget, baseline design is currently under evaluation by the ET community.

Strong technological synergies with ECFA community expertise on high vacuum of large volumes, …



Contribution to ESPP in multiple ways is also helping us in the preparation of the APPEC Strategy Plan 2027-2036 !